Environmental Defenders Office

Submission to the NSW Independent Bushfire Inquiry

16 April 2020

About EDO

EDO is a community legal centre specialising in public interest environmental law. We help people who want to protect the environment through law. Our reputation is built on:

Successful environmental outcomes using the law. With over 30 years' experience in environmental law, EDO has a proven track record in achieving positive environmental outcomes for the community.

Broad environmental expertise. EDO is the acknowledged expert when it comes to the law and how it applies to the environment. We help the community to solve environmental issues by providing legal and scientific advice, community legal education and proposals for better laws.

Independent and accessible services. As a non-government and not-for-profit legal centre, our services are provided without fear or favour. Anyone can contact us to get free initial legal advice about an environmental problem, with many of our services targeted at rural and regional communities.

Environmental Defenders Office is a legal centre dedicated to protecting the environment.

www.edo.org.au

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Introduction

The Environmental Defenders Office (**EDO**) welcomes the opportunity to make a submission to the NSW Independent Bushfire Inquiry.

The summer bushfire season of 2019-20 (herein referred to as the **bushfires**) was the most devastating on record. Catastrophic bushfires in NSW led to more than 2400 homes being destroyed and 25 lives lost.[1] The bushfires also had a devastating impact on natural landscapes, ecosystems and native wildlife. Initial assessment by the NSW Government (as of 3 February 2020) indicates the fire ground in NSW covers 5.4 million hectares (7% of the state), including 2.7 million hectares in national parks (37% of the NSW park system), and habitat of more than 293 threatened animals and 680 threatened plants have been impacted.[2] While it is difficult to estimate the exact numbers of native animals killed, some experts predict it could be as many as 800 million in NSW.[3]

As a community legal centre specialising in public interest environmental and planning law, EDO's submission addresses the terms of reference (**ToRs**) through an environmental law lens. We focus on the key environmental drivers of bushfires, principally climate change, and how these should be addressed in ecologically sustainable, science-based laws, regulations and strategies to protect life and property and the environment from the impacts of bushfires.

To that end, our submission:

1. Briefly outlines environmental causes and factors contributing to the frequency , intensity, timing and location of bushfires (**ToR 1**);

2. Discusses the preparation and planning by agencies, government, other entities and the community for bushfires in NSW, specifically focusing on the climate-readiness of NSW laws (**ToR 2)**, and including input on land use planning and management for bushfire protection **(ToR 6**);

3. Examines responses to bushfires (**ToR 3 and 4**), including in relation to:

    - bushfire management practices that are science-based and are ecologically sustainable; and

    - the ongoing protection and restoration of the environment from the impacts of the bushfires.

We make a number of recommendations throughout our submission, including recommendations on preparing and planning for future bushfire threats and risks (**ToR 5**) and appropriate action to adapt to bushfire risks to communities and ecosystems (**ToR 7**).

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[1] Climate Council of Australia, *Summer of Crisis*, March 2020, available at https://www.climatecouncil.org.au/wp-content/uploads/2020/03/Crisis-Summer-Report-200311.pdf

[2] See NSW Department of Planning, Industry and Environment, *Understanding the effects of the 2019–20 fires*, available at https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/park-recovery-and-rehabilitation/recovering-from-2019-20-fires/understanding-the-impact-of-the-2019-20-fires

[3] Professor Chris Dickman, Faculty of Science, University of Sydney. For an explanation of Professor Dickman's estimates see https://www.sydney.edu.au/news-opinion/news/2020/01/08/australian-bushfires-more-than-one-billion-animals-impacted.html

In preparing our submission, we have relied on expert input from Dr Philip Zylstra, specifically on the influence of fire on subsequent risk and the role of prescribed burning. Advice provided from Dr Zylstra is included in **Attachment 1**.

Beyond that, we do not address aspects of the ToRs that are better addressed by other experts, including in relation to immediate bushfire management, emergency responses coordination, safety of first responders and public communication and advice systems and strategies.

Summary of Recommendations

Recommendation 1: Recognise the role of climate change and drought in contributing to the frequency, intensity, timing and location of the 2019-20 bushfires in NSW, and the potential contribution of climate change and associated impacts to future bushfire seasons.

Recommendation 2: Implement a whole-of-government approach to climate change by enacting new climate change laws in NSW that deal with both climate change mitigation and adaptation in a clear and coordinated way.

Recommendation 3: Review all relevant NSW legislation with a view to incorporating clear requirements for climate change mitigation and adaptation.

Recommendation 4: Require all NSW agencies to carry out their respective functions consistent with the need to mitigate greenhouse gas emissions in line with the science, and adapt to the impacts of climate change.

Recommendation 5: Ensure NSW planning laws are climate-ready by implementing relevant recommendations set out in EDO's *Climate-ready planning laws for NSW – Rocky Hill and beyond* report, and also:

- Explicitly require climate risks to be considered when assessing development proposals on bushfire prone land.
- Explicitly require decision-makers to assess the increasing risks and impacts of climate change on development proposals, including the proposal itself and the locality, particularly with reference to climate projections of increased temperature, sea level rise, variable rainfall or future bushfire risks.
- Ensure local councils and the Rural Fire Service have sufficient capacity and capability to continually update mapping and responsiveness to reflect the best available science and technology, including in relation to climate change projections.

Recommendation 6: Explicitly require climate change risks to be considered in decision-making (particularly in relation to bush fire planning) under the *Rural Fires Act 1997* (**RF Act**), and addressed consistent with the principles of ESD.

Recommendation 7: Include provisions in NSW emergency legislation that explicitly require plans developed under emergency legislation to factor climate change into decision-making, risk assessment and management, or disaster preparedness, and be addressed consistent with the principles of ESD.

Recommendation 8: Undertake research to quantify resources needed to enable more fires to be contained at a small size and minimise the need for backburning, and based on the findings of that research allocate resources to NSW fire agencies accordingly.

Recommendation 9: Recognise the value of long-undisturbed forest in mitigating landscape fire risk in fire management planning.

Recommendation 10: Ensure that prescribed burning and other methods of reducing risk via disturbance are applied close to assets where they may provide material benefit.

Recommendation 11: Ensure that there is independent, scientific oversight of bush fire management regulation and policy in NSW.

Recommendation 12: Reject environmentally destructive, unsubstantiated bushfire management practices such as grazing in national parks and selective logging.

Recommendation 13: Recognise Indigenous land management and cultural burning, and facilitate its incorporation into NSW bushfire management practices.

Recommendation 14: Require consent authorities to consider the impacts of the 2019-20 bushfires before determining development applications, including updated environmental assessments where necessary.

Recommendation 15: Revise Regional Forest Agreements (RFAs) to take into account the extensive forest losses that have resulted from the bushfires.

Recommendation 16: Suspend current forestry operations, where their continuation would affect remaining stands of habitat for threatened species.

Recommendation 17: Suspend wildlife licences until the impact of the bushfires on relevant wildlife has been fully assessed.

1. Environmental causes and factors contributing to the frequency, intensity, timing and location of bushfires (ToR 1)

While this inquiry will examine a range of potential causes and drivers of the devastating bushfires, our submission will focus on the key environmental drivers contributing to extended and more intense bushfires, namely climate change and drought.

Australia's climate has warmed by just over one degree Celsius (**°C**) since 1910 and the best available science tells us that average temperatures are projected to rise further.[4] Australia is already experiencing the impacts of climate change, which include the warming and acidification of oceans,

[4] See Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Climate change in Australia - Projections for Australia's NRM regions*, https://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/clusters/; see also NSW Department of Planning, Industry and Environment, *AdaptNSW*, https://climatechange.environment.nsw.gov.au/

sea level rise, decreased rainfall in southern parts of the country and increased rainfall in the north, and the long-term increase in extreme fire weather. Extreme heat days, longer dry spells, and harsher fire weather will increasingly become the norm, although the severity of impacts will be less if emissions can be reduced.[5]

The Intergovernmental Panel on Climate Change (**IPCC**) is highly confident that:

> *Without additional mitigation efforts beyond those in place today, and even with adaptation, warming by the end of the 21st century will lead to high to very high risk of severe, widespread, and irreversible impacts globally…*[6]

Predicted impacts for NSW include:

- up to 10 additional days above 40 °C each year in northern NSW by 2030, rising to 33 additional days by 2070;
- increased crop failure, human and animal deaths;
- longer and more intense bushfire seasons;
- accelerated biodiversity loss; and
- increased irreversible soil erosion, affecting food security and water quality.[7]

The major drought event being experienced in NSW (which began in mid-2017)[8] also contributed to the severity of the bushfires. The Bureau of Meteorology advised that the high fire dangers in spring 2019 "*were exacerbated by widespread and severe rainfall deficiencies and hydrological drought, with continued low rainfall during spring and much above average temperatures*".[9] Climate change is driving an increase in the intensity and frequency of hot days and heatwaves in Australia, exacerbating drought conditions.[10]

The evidence relating to climate change and drought led the Climate Council of Australia to advise in November 2019 that:

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[5] The impacts of a warming climate on Australia are set out in more details in Bureau of Meteorology and CSIRO, *State of the Climate 2018* (2018), www.bom.gov.au/state-of-the-climate

[6] Intergovernmental Panel on Climate Change (IPCC) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] (2014) p 17, http://www.ipcc.ch/report/ar5/syr/

[7] See for example NSW Department of Planning, Industry and Environment, *Impacts of Climate Change* AdaptNSW: http://climatechange.environment.nsw.gov.au/impacts-of-climate-change; See also CSIRO, *New climate change projections for Australia* (27 January 2015), http://www.csiro.au/en/News/News-releases/2015/New-climate-change-projections-for-Australia

[8] NSW Department of Primary Industries, https://www.dpi.nsw.gov.au/climate-and-emergencies/droughthub/drought-in-nsw

[9] Bureau of Meteorology, *Special Climate Statement 72—dangerous bushfire weather in spring 2019,* 18 December 2019, http://www.bom.gov.au/climate/current/statements/scs72.pdf

[10] Climate Council of Australia, *Factsheet: Climate change and drought factsheet,* June 2018, https://www.climatecouncil.org.au/wp-content/uploads/2018/06/CC_MVSA0146-Fact-Sheet-Drought_V2-FA_High-Res_Single-Pages.pdf

"the catastrophic, unprecedented fire conditions currently affecting NSW and Queensland have been aggravated by climate change. Bushfire risk was exacerbated by record breaking drought, very dry fuels and soils, and record-breaking heat".[11]

There is little doubt that climate change is exacerbating a number of drivers that are contributing to more intense bushfire seasons including reduced rainfall, drier conditions and more extreme heat days. Future preparation and planning for bushfire threats and risks must acknowledge and prepare for the predicted impacts of climate change.

Recommendation 1: Recognise the role of climate change and drought in contributing to the frequency, intensity, timing and location of the 2019-20 bushfires in NSW, and the potential contribution of climate change and associated impacts to future bushfire seasons.

2. The preparation and planning by agencies, government, other entities and the community for bushfires in NSW, including current laws, practices and strategies (ToR 2)

EDO has long argued that NSW laws are not climate-ready. Given that climate change is the key environmental driver behind longer, more intense bushfire seasons in NSW, our submission:

a) Provides a brief overview of the failure of NSW laws generally to mitigate greenhouse gas emissions and plan for adapting to the impacts of climate change; and
b) Examines whether the specific laws, practices and strategies for bushfire preparation and planning adequately factor in climate change considerations.

2.1 Failure of NSW laws to mitigate greenhouse gas emissions and adapt to the impacts of climate change

In light of the unequivocal scientific evidence of the impacts of anthropogenic climate change (which includes longer, more intense bushfire seasons), the international community agreed in late 2015 to keep the increase in global average temperature to well below 2°C above pre-industrial levels; and to pursue efforts to limit the increase to 1.5 °C.[12]

The Climate Council of Australia advised that *"(f)or Australia to play its role in preventing a 2°C rise in temperature requires over 90% of Australia's coal reserves to be left in the ground, unburned*". This means that we can no longer continue with "business as usual" when it comes to fossil fuel projects; opening up new fossil fuel development is inconsistent with the science of mitigating climate change.

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[11] Climate Council of Australia, *Briefing Note - 'This is Not Normal': Climate change and escalating bushfire risk*, November 2019, available at https://www.climatecouncil.org.au/wp-content/uploads/2019/11/bushfire-briefing-paper_18-november.pdf

[12] In December 2015, over 190 nations affirmed a goal to reduce greenhouse gas emissions in order to limit average global warming to well below 2ºC above pre-industrial levels and to pursue efforts to limit warming to 1.5ºC. United Nations Framework Convention on Climate Change Conference of the Parties 21, *Adoption of the Paris Agreement*, 'Annex - Paris Agreement', Article 2 (FCCC/CP/2015/L.9/Rev.1). The Paris Agreement builds on past international commitments in Cancun, Lima and elsewhere under the 1992 UN Framework Convention on Climate Change.

The Special Report of the IPCC released in 2018 indicates that current actions are not enough to limit warming to 1.5°C, and makes it clear that the consequences of warming beyond 1.5°C are dire.[13] Failing to limit global warming to 1.5 °C will have catastrophic impacts including greater levels of sea-level rise and coastal inundation, extreme heatwaves, severe droughts, the death of coral reefs, and mass extinctions.[14] And the impacts of climate change are not just environmental; there will be significant implications across all sectors, including health, the economy and national security.[15]

Despite the urgency, the legal and governance frameworks needed to achieve the global commitment to reduce greenhouse gas emissions and limit global warming are mostly absent. NSW is no exception. Our laws fall far short of what is needed, with many of our important environment and planning laws remaining silent when it comes to climate change.

In particular we note that:

- In NSW, there is no overarching legal framework creating obligations for reducing greenhouse gas emissions, or implementing adaptation measures (e.g. a NSW Climate Change Act).[16]
- There is no prohibition on new fossil fuel projects, or clear plan for a rapid and just transition away from fossil fuel production and use, consistent with advice from the IPCC.
- The NSW Environment Protection Authority does not have a clear climate change policy, including to regulate and reduce greenhouse gas emissions, despite being required to develop environmental quality objectives, guidelines and policies to ensure environment protection.[17]
- The NSW pollution licensing system does not generally limit greenhouse gas emissions, or charge load-based licence fees on carbon dioxide and methane emissions.[18]
- The NSW planning system contains no explicit reference to climate change, or specific provisions for mitigating greenhouse gas emissions or implementing adaptation measures.[19] There are no effective requirements in the planning system to consider and mitigate scope 1, 2 and 3 greenhouse gas emissions.

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[13] Intergovernmental Panel on Climate Change, Special Report Global Warming of 1.5oC, An IPCC Special Report on the impacts of global warming of 1.5oC above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, (2018), https://www.ipcc.ch/sr15/

[14] Ibid.

[15] For example, the World Health Organisation (WHO) advises that climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter, and that between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress, see https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health. In 2017, the Australian Senate Foreign Affairs, Defence and Trade References committee recognised climate change as a current and existential national security risk, see https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/Nationalsecurity/Final_Report. The Reserve Bank of Australia has recently announced that banks, business and investors must think about the economic impacts of climate change, see https://www.abc.net.au/news/2019-03-12/reserve-bank-warns-of-impact-of-climate-change-on-the-economy/10893792

[16] Environmental Defenders Office, *Climate-ready planning laws for NSW – Rocky Hill and beyond,* p 17-21 available at: https://www.edonsw.org.au/climate_ready_planning_laws

[17] See section 9 of the *Protection of the Environment Administration Act 1991* (NSW)

[18] Environmental Defenders Office, *Climate-ready planning laws for NSW – Rocky Hill and beyond,* p 51, available at: https://www.edonsw.org.au/climate_ready_planning_laws

[19] Environmental Defenders Office, *Climate-ready planning laws for NSW – Rocky Hill and beyond,* available at: https://www.edonsw.org.au/climate_ready_planning_laws

- Climate change considerations are not adequately embedded into NSW biodiversity conservation laws.[20]
- Little domestic research or policy has been dedicated to understanding and managing the complex relationship between water and greenhouse gas mitigation and adaptation measures,[21] and NSW water laws are not adequately are equipped to mitigate climate-related risk.[22]

Until we have effective legal frameworks in place to mitigate greenhouse gas emissions, global temperatures will continue to rise and the impacts of global warming, including longer and more intense bushfire seasons, will continue to impact the communities, ecosystems and wildlife of NSW.

Recommendations

- **Recommendation 2:** Implement a whole-of-government approach to climate change by enacting new climate change laws in NSW that deal with both climate change mitigation and adaptation in a clear and coordinated way.
- **Recommendation 3:** Review all relevant NSW legislation with a view to incorporating clear requirements for climate change mitigation and adaptation.
- **Recommendation 4:** Require all NSW agencies to carry out their respective functions consistent with the need to mitigate greenhouse gas emissions in line with the science, and adapt to the impacts of climate change.

2.2. Do specific laws, practices and strategies for bushfire preparation and planning adequately factor in climate change considerations?

2.2.1 Planning laws

The interaction between bushfire preparedness and land use planning has long been recognised. A 2014 report from the former Bushfire Cooperative Research Centre found that *"(t)he succession of bushfire inquiries over the last 100 years increasingly highlights the important role of land use planning in minimising bushfire risk to urban communities*".[23]

In NSW, substantial changes were made to the *Environmental Planning and Assessment Act 1979* (**EP&A Act**) in 2002 to strengthen the way NSW planning laws responded to bushfire risks. Key changes included requiring councils to identify bushfire prone land, legislative requirements to comply with *Planning for Bushfire Protection* (***PBP***) guidelines, referrals of certain development

[20] See generally Environmental Defenders Office *Submission on the draft Biodiversity Conservation Bill 2016*, available at https://www.edonsw.org.au/biodiversity_legislation_review
[21] See Dr Emma Carmody, Environmental Defenders Office, *Climate change is water change: integrating water management, mitigation and adaptation laws and policies*, Australian Environment Review, 2017. Vol 31 No 10.
[22] Dr Emma Carmody, Environmental Defenders Office, *Presentation to 10th Water Symposium*, hosted by Legalwise in Sydney on 18 October 2019, available at https://www.edo.org.au/2019/12/19/are-water-laws-climate-ready/
[23] Norman B, Weir JK, Sullivan K and Lavis J (University of Canberra), (2014), *Planning and bushfire risk in a changing climate*, Bushfire CRC, Australia, p 3, available at https://www.bushfirecrc.com/sites/default/files/urban_and_regional_planning.pdf

to the Commissioner of the Rural Fire Service (**RFS**) and streamlining of the approval process for planned hazard reduction works.[24]

These initiatives have been retained and strengthened, and currently:

- Bush fire prone land must be mapped (EP&A Act, section 10.3).
- Development consent[25] cannot be granted on bush fire prone land unless the development complies with the *PBP* or is certified by a relevant bushfire consultant (EP&A Act, section 4.14). However this section does not apply to State significant development.
- The *Standard Instrument - Principal Local Environmental Plan* includes a compulsory clause (cl 5.11) that bush fire hazard reduction work authorised by the *Rural Fires Act 1997* (**RF Act**) may be carried out on any land without development consent.
- Ministerial Direction 4.4 (made under section 9.1 of the EP&A Act) directs planning authorities preparing planning proposals (to make or amend a Local Environment Plan (**LEP**)) that will affect, or is in proximity to land mapped as bushfire prone land, to consult with the Commissioner of the NSW RFS, and ensure the planning proposal has regard to *PBP*, introduces controls that avoid placing inappropriate developments in hazardous areas, and ensures that bushfire hazard reduction is not prohibited within Asset Protection Zones (**APZs**).
- Development must comply with the Building Code of Australia[26] and standards included therein, including *AS3959-2018 – Construction of building in Bushfire Prone Areas*.[27]
- *PBP* was updated in 2018/2019.[28] This was the first time that *PBP* had been reviewed since 2006. Key changes include a new chapter on strategic planning, new information covering development in grassland areas, a different set of fuel loads have been used to define the setbacks required for development in NSW, and changes to how information on fire weather areas and landscaping guidelines is made available via *PBP* and other means.[29]

However, the key factor missing in NSW planning laws with respect to managing bushfire risk is the explicit requirement for the increased risk of bushfires from climate change to be factored into decision-making. For example:

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[24] New South Wales, *Parliamentary Debates*, Legislative Assembly 30 May 2002, The Hon. Bob Debus, Attorney General, Minister for the Environment, Minister for Emergency Services, and Minister Assisting the Premier on the Arts, https://www.parliament.nsw.gov.au/bill/files/3215/A6702.pdf

[25] For any purpose, other than a subdivision of land that could lawfully be used for residential or rural residential purposes or development for a special fire protection purpose. Development for those purposes must be authorised by a bush fire safety authority under section 100B of the *Rural Fires Act 1997.*

[26] *Environmental Planning and Assessment Regulation 2000*, cl 98.

[27] See https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area

[28] A pre-release *Planning for Bushfire Protection 2018* was released before *Planning for Bushfire Protection 2019* was finalised.

[29] Information on *Planning for Bushfire Protection,* including a summary of key changes fact sheet is available on the Rural Fire Service website: https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection

- Generally, the EP&A Act contains no explicit requirement to assess the increasing risks and impacts of climate change on the proposal or the locality, particularly with reference to climate projections of increased temperature, sea level rise, variable rainfall or future bushfire risks.
- There is no requirement for the RFS to account for climate risks when it signs off on new developments under the EP&A Act.[30]
- While we understand that there was a review and consultation process in updating *PBP*, there is little public information available about that process, including issues raised during the review, whether advice from the independent Climate Change Council was sought or reasons for decisions. Therefore it is unclear to what extent the review relied upon or incorporated climate change considerations, if at all. What is clear is that the updated *PBP* makes no explicit reference to climate change.[31] This was a missed opportunity to incorporate climate change considerations into *PBP* and ought to be rectified in the recommendations arising out of this inquiry (see further discussion on the RF Act below).
- It is critical that local councils and the RFS have sufficient capacity and capability to continually update mapping and responsiveness to reflect the best available science and technology, including in relation to climate change projections.

It is also noted that the EP&A Act assessment process applies to new development proposals, with limited ability to retrospectively update or modify consent conditions or require retrofitting of existing development. As such, the EIA process does not consider the increasing risks and impacts from increased bushfire risk on existing homes, buildings, infrastructure or surrounding landscapes – nor the need to increase community and environmental resilience to these threats. There are no retrofitting requirements for buildings, for example. Nor is there a significant assistance or compliance and audit program for existing homes, businesses or infrastructure to assess vulnerability to climate risks such as bushfire.

Recommendations

- **Recommendation 5:** Ensure NSW planning laws are climate-ready by implementing relevant recommendations set out in EDO's *Climate-ready planning laws for NSW – Rocky Hill and beyond* report, and also:

    - Explicitly require climate risks to be considered when assessing development proposals on bushfire prone land.
    - Explicitly require decision-makers to assess the increasing risks and impacts of climate change on development proposals, including the proposal itself and the

[30] For example, section 4.14 of the EP&A Act requires development on bush fire prone land to conform with the *Planning for Bushfire Protection*, but there are no specific requirements to consider climate change. Similarly there is no requirement to consider climate change in issuing a bushfire safety authority under the *Rural Fires Act 1997* (s 100B).
[31] The *Planning for Bushfire Protection 2006* guidelines were recently reviewed and an updated and the new *Planning for Bushfire Protection 2019* came into effect on 1 March 2020, see https://www.planning.nsw.gov.au/Policy-and-Legislation/Managing-risk-in-land-use-planning/Bushfires/Development-Regulations and https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection

locality, particularly with reference to climate projections of increased temperature, sea level rise, variable rainfall or future bushfire risks.

- Ensure local councils and the Rural Fire Service have sufficient capacity and capability to continually update mapping and responsiveness to reflect the best available science and technology, including in relation to climate change projections.

2.2.2 Rural Fires Act

The RF Act establishes the NSW RFS and its functions, and makes provision for the prevention, mitigation and suppression of rural fires. The RF Act interacts with other environment and planning legislation (including the EP&A Act as outlined above) in a number of ways. For example, the RF Act:

- Contains provisions regarding bushfire hazard reduction, including:
    - that certain other legislation (including the EP&A Act, *Biodiversity Conservation Act 2016* (**BC Act**) and *National Parks and Wildlife Act 1974* (**NP&W Act**) cannot restrict the carrying out of certain bush fire hazard reduction work;
    - a streamlined environmental assessment process for issuing bushfire hazard reduction certificates; and
    - the process for developing bush fire environmental assessment codes (which must be considered in relation to bush fire hazard reduction works).[32]
- Sets out the requirements for issuing bushfire safety authority for subdivision of bush fire prone land or development of bush fire prone land for a special fire protection purpose.[33]
- Sets out the process for development Bush Fire Risk Management Plans.

Again, the key factor missing in the RF Act with respect to managing bushfire risk is the explicit requirement for the increased risk of bushfires from climate change to be factored into decision-making. For example:

- there is no explicit requirement to consider climate change in issuing a bushfire safety authority under the RF Act (s 100B);
- there is no explicit requirement to consider climate change in preparing bush fire environmental assessment codes, although there is a requirement to consider the principles of ecologically sustainable development (**ESD**) (s 100J); and
- there is no explicit requirement to consider climate change in preparing Bush Fire Risk Management Plans (BFRMPs) (Part 3, Division 4), although a Bush Fire Management Committee is required to consider the principles of ecologically sustainable development in carrying out any function (which includes the preparation of a BFRMP)

[32] *Rural Fires Act 1997*, Part 4, Division 8, Subdivision 3 and 4.
[33] *Rural Fires Act 1997*, Part 4, Division 8, Subdivision 2.

that affects the environment (s 51) and in practice BFRMPs do acknowledge climate risk.[34]

Recommendations

Recommendation 6: Explicitly require climate change risks to be considered in decision-making (particularly in relation to bush fire planning) under the RF Act, and addressed consistent with the principles of ESD.

2.2.3 Emergency management laws

General emergency management in NSW is coordinated under, and governed by, the *State Emergency and Rescue Management Act 1989*, and a number of plans made thereunder, chief of which is the State Emergency Management Plan (**EMPLAN**). The EMPLAN sets out the roles and responsibilities of agencies and relevant stakeholders in the management of emergencies in NSW.

Further to this, certain hazards are allocated by legislation to specific agencies. Fire, including bushfires, is such a hazard and is the responsibility of Fire and Rescue NSW (governed by the *Fire and Rescue NSW Act 1989*) in urban areas, and the RFS (governed by the RF Act) in rural areas. The State Bushfire Management Plan, a sub-plan of the EMPLAN, describes the arrangements for the control and coordination of the response to (Class 2 and 3) bush and grass fires and to emergency warning for all classes of fires. Further, the RF Act provides the establishment or Local Bushfire Management Committees and for the preparation of Bushfire Risk Management Plans.

None of the State's key emergency legislation or plans factor climate change into decision-making, risk management, or disaster preparedness. This could be considered a failure by the Minister of their duty under the *State Emergency and Rescue Management Act 1989* to ensure that "adequate measures are taken by government agencies to prevent, prepare for, respond to and assist recovery from emergencies".[35]

Given the clear link between climate change and the increasing severity of bushfires in NSW, it is recommended that there be an explicit requirement in relevant legislation that the best available science regarding climate change impacts on the likelihood, severity, and locations of bushfires be relied upon in the formulation of measures to prevent, prepare for, respond to and assist recover from bushfires. By way of example, the *Government Code* of California requires[36] that local hazard mitigation plans[37] address climate adaptation and resiliency, based on an assessment including an assessment of how climate change may affect wildfire risks. In

[34] Bush Fire Risk Management Plans for each region can be found at https://www.rfs.nsw.gov.au/plan-and-prepare/know-your-risk/bush-fire-risk-management-plans
[35] *State Emergency and Rescue Management Act 1989*, s 10(1)(a)).
[36] At s65302. See SB-379, available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB379.
[37] Adopted in accordance with the federal *Disaster Mitigation Act of 2000*.

addition, the California State Hazard Mitigation Plan[38] incorporates climate change models into its assessment of, amongst other things, wildfire vulnerability.[39]

Recommendations

Recommendation 7: Include provisions in NSW emergency legislation that explicitly require plans developed under emergency legislation to factor climate change into decision-making, risk assessment and management, or disaster preparedness, and be addressed consistent with the principles of ESD.

3. Responses to bushfires - protection of the environment (ToR 3 and 4)

Bushfires and bushfire management practices have a significant impact on ecosystems, natural landscapes and environments. EDO's submission considers two important components of responding to bushfire, namely:

3.1 Bushfire management practices that are science-based and ecologically sustainable; and
3.2 The ongoing protection and restoration of the environment from the impacts of the bushfires.

3.1 Bushfire management practices that are science-based and ecologically sustainable

We support bushfire management practices that are science-based, protect lives and property and are ecologically sustainable. Bushfires can have a significant impact on ecosystems, natural landscapes and environments. Firefighting responses have the capacity to alter this impact either positively or negatively, depending upon the strategies and tactics used to combat the fire.

Backburning tactics for example could be expected to have high impacts on environments through the interaction of fire-fronts and the trapping of wildlife between approaching fronts, whereas aggressive fire suppression tactics early in a fire event may minimise burnt areas.

Backburning becomes an increasingly common tactic as fires grow in size and the perimeters become too large to contain directly, so a fundamental question is whether there were ways in which fires could have been contained at a smaller size using more aggressive tactics? Were adequate numbers of Remotely Trained Fire Teams (RAFT) and support aircraft available? Were small, remote ignitions prioritised for rapid suppression, or were they treated as lower priority because they did not immediately threaten life and property assets? Were backburns conducted through high conservation value or World Heritage environments without recognition of their value as assets?

Research to quantify resources that would enable more fires to be contained at a small size and minimise the need for backburning, using the bushfires as focus, should be prioritised. If this research finds that close containment is an effective and more environmental appropriate approach, the

[38] Required by 44 Code of Federal Regulations (**CFR**) Part 201 Mitigation Planning.
[39] See California State Hazard Mitigation Plan, September 2018, Section 8.1, available at https://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/state-hazard-mitigation-plan

findings could form the basis of plans to transition firefighting resources toward rapid suppression and close containment.

Following the bushfires, there has also been considerable discussion about prescribed burning, including whether it can reduce the spread and severity of bushfires and whether adequate prescribed burning was undertaken prior to the bushfire season. In this context, it must be recognised that these fires occurred at the peak of historic prescribed burning frequency in NSW national parks. Analysis of Department of Planning Industry and Environment (**DPIE**) mapped records[40] indicate that, in the decade leading up to the bushfires, more than twice the area of national park estate was burnt for fuel management compared to the previous decade, and more than the total in any of the five mapped decades prior to that.[41] If a lack of prescribed burning leads to large fires, then fires of this scale would have been more likely across the national park estate during the previous five decades when less of it was being carried out. There is no prima facie argument to support the claim that the bushfires resulted from a lack of prescribed burning.

Empirical evidence for the effectiveness of prescribed burning in NSW also conflicts with the claim that more hectares should have been burnt. Analysis following the 2009 Black Saturday fires found that very recent burns conducted close to structures did provide a small level of assistance in protecting those structures, but, critical to this inquiry, there was no evidence that remote burns provided any assistance in protecting houses.[42] To our knowledge, despite decades of research, no evidence yet exists to show that burning remote areas provides any material protection to houses, yet the pressure to burn more area results in an increase in burning of remote hectares and a reduction in treatments adjacent to assets, where they may provide assistance.[43] Regular burning of bush land has the potential to lead to environmental degradation, so prescribed burning should only be conducted at a location and scale where this loss is deemed acceptable or unavoidable, or can be mitigated consistent with the principle s of ecologically sustainable development. For further information, please further to the expert report provided by Dr Philip Zylstra at **Attachment 1**.

Following significant bushfire events, perceived tensions between conservation, asset protection and disaster preparedness present risks of 'maladaptation' and can lead to perverse outcomes. For example, following bushfire events in October 2013, where 1,157 bushfires burnt across NSW, including six major bushfires at Port Stephens, in the Blue Mountains, in the Southern Highlands and on the Central Coast,[44] the NSW Government introduced the *Rural Fires Amendment (Vegetation Clearing) Act 2014* (**the 10/50 Bushfire Code**) which provided new vegetation clearing rules for homeowners in designated bushfire prone areas. The 10/50 Bushfire Code led to widespread reports of suburban trees being felled to enhance views, rather than protect from threats – at a time when the cooling effects of street trees were being recognised, and the Government was embarking on a

[40] https://datasets.seed.nsw.gov.au/dataset/fire-history-wildfires-and-prescribed-burns-1e8b6
[41] https://www.abc.net.au/news/2020-01-22/prescribed-burning-nsw-backburning-hazard-reduction/11878316
[42] Price, O. F. & Bradstock, R. A. The efficacy of fuel treatment in mitigating property loss during wildfires: Insights from analysis of the severity of the catastrophic fires in 2009 in Victoria, Australia. *J. Environ. Manage.* **113**, 146–157 (2012)., Gibbons, P. *et al.* Land management practices associated with house loss in wildfires. *PLoS One* **7**, e29212 (2012).
[43] Inspector-General for Emergency Management. Review of performance targets for bushfire fuel management on public land. (2015).
[44] See NSW Parliamentary Research Service, *Rural Fires Amendment (Vegetation Clearing) Bill 2014,* June 2014 e-brief 09/2014, https://www.parliament.nsw.gov.au/researchpapers/Documents/rural-fires-amendment-vegetation-clearing-bill-2/Rural%20Fires%20Amendment%20(Vegetation%20Clearing)%20Bill%202014.pdf

program to plant 5 million trees in Western Sydney. Significant pushback from the community resulted in a review of the 10/50 Bushfire Code and subsequent changes to the rules to limit perverse tree clearing.[45]

There is a real risk that following the bushfires of the 2019-20 summer, the incentive to make swift and far-reaching changes to bushfire management practices will undermine science-based, ecologically sustainable bushfire management practices that protect lives, property and the environment. For example, following the bushfires, there have been renewed calls to allow grazing in national parks.[46] Grazing of livestock in alpine areas has been shown to have little to no effect on the severity of bushfires.[47] Further, in our view, grazing by livestock in national parks is inconsistent with the objects of the *National Parks and Wildlife Act 1974.*

Similarly, the decision to allow selective logging in certain fire-affected areas,[48] flies in the face of substantial evidence warning against post-fire logging. Detailed studies by the Australian National University, including those done after Victoria's devastating Black Saturday fires, showed that post-fire logging did widespread damage to forest recovery.[49] It hampers species recovery, destroying important areas for refuge, and has negative effects on water, increasing sedimentation and catalysing erosion. Perhaps counter-intuitively, the research also showed that post-fire logging increases future fire risk.

EDO does not support environmentally destructive, unsubstantiated practices introduced under the guise of bushfire management.

Finally, this inquiry should ensure that the views and knowledge of Indigenous landowners regarding land management and cultural burning is considered as part of the inquiry, and make recommendations for recognising and facilitating Indigenous land management and cultural burning, including incorporating this into NSW bushfire management practices.

Recommendations

- **Recommendation 8:** Undertake research to quantify resources needed to enable more fires to be contained at a small size and minimise the need for backburning, and based on the findings of that research allocate resources to NSW fire agencies accordingly.
- **Recommendation 9:** Recognise the value of long-undisturbed forest in mitigating landscape fire risk in fire management planning.

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[45] See NSW Government, *Review of the 10/50 Vegetation Clearing Entitlement Scheme*, August 2015 https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0019/33607/Review-of-the-1050-Vegetation-Clearing-Entitlement-Scheme-Report.pdf

[46] See, for example, Sydney Morning Herald, *'Cows can't stop bushfires': Minister at odds with Nats*, 18 November 2019.

[47] See, for example, Grant, J. et.al., *Cattle grazing does not reduce fire severity in eucalypt forests and woodlands of the Australian Alps,* Austral Ecology (2014) 39, 462–468; Williams, R.J., et.al. *Does alpine grazing reduce blazing? A landscape test of a widely-held hypothesis' Austral Ecology* 31 (2006) 925-36; Kirkpatrick, J.B., et. al '*Influence of Grazing and Vegetation Type on Post-Fire Flammability'* (2011), *Journal of Applied Ecology* 48.3 (2011) 64- 649.

[48] See https://www.forestrycorporation.com.au/operations/about-our-harvesting-operations/fire-affected-native-forests

[49]See, for example, Lindenmayer1, D. et.al., *Effects of logging on fire regimes in moist forests,* Conservation Letters 2 (2009) 271–277; Lindenmayer1, D. et.al., *Please do not disturb ecosystems further,* Nature Ecology and Evolution, 1, 0031 (2017) 1-3.

- **Recommendation 10:** Ensure that prescribed burning and other methods of reducing risk via disturbance are applied close to assets where they may provide material benefit.
- **Recommendation 11:** Ensure that there is independent, scientific oversight of bush fire management regulation and policy in NSW.
- **Recommendation 12:** Reject environmentally destructive, unsubstantiated bushfire management practices such as grazing in national parks and selective logging.
- **Recommendation 13:** Recognise Indigenous land management and cultural burning, and facilitate its incorporation into NSW bushfire management practices.

3.2 The ongoing protection and restoration of the environment from the impacts of the bushfires

EDO has had a considerable number of inquiries from members of the community concerned about the recovery of native wildlife and ecosystems post-bushfires. While the ToRs focus specifically on responding to fires and immediate steps that can be taken to protect life, property and the environment, consideration should also be given to the long-term impacts of the bushfires on the environment and the steps needed to help ecosystems and wildlife recover from the impacts of the bushfires.

The extent and severity of the bushfires represents a substantial change in the long-term viability of many populations of threatened species and ecological communities, which is not yet fully understood. Initial assessments undertaken by DPIE indicate that bushfires have affected:

- 30% of bushland where 32 threatened animal species have previously been sighted;
- 5% of bushland where 114 threatened animal species have previously been sighted;
- 97.1% of bushland where the critically endangered Long-footed Potoroo (*Potorous longipes*) has previously been sighted;
- 81.7% of bushland where the endangered Brush-tailed Rock-wallaby (*Petrogale penicillata*) has previously been sighted;
- 89.3% of bushland where the endangered frog (*Philoria pughi*) has previously been sighted;
- 81.9% of bushland where the endangered Hastings River mouse (*Pseudomys oralis*) has previously been sighted; and
- 24% of all modelled habitat for the vulnerable Koala (*Phascolarctos cinereus*) in eastern NSW.[50]

Having regard to DPIE's preliminary analysis of the significant reduction in threatened species habitat caused by bushfires, we are concerned that:

- The impacts that proposed developments will have on remaining threatened species and ecological communities cannot be adequately assessed until the damage to habitat and

[50] Department of Planning, Industry and Environment, *Wildlife and Conservation Bushfire Recovery: Immediate Response,* January 2020, available at available at https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Fire/wildlife-and-conservation-bushfire-recovery-immediate-response-january-2020-200027.pdf

populations caused by the bushfires is known. Current environmental assessments on which decision-makers are relying may now be out-of-date;
- The significance of previously assessed impacts of certain developments with existing consents on threatened species and communities may have substantially increased; and
- The bushfires have so severely impacted the existing habitat of some threatened species and communities that any further reduction in that habitat caused by certain developments may constitute new impacts on threatened species or communities that were not assessed at the time consent was granted for those developments.

To that end, in February 2020 EDO, in partnership with our client Humane Society International Australia, wrote to the NSW Premier recommending that the Premier takes steps to ensure the protection of threatened species and ecological communities that have been affected by the bushfires.[51]

Our letter makes a number of recommendations for ensuring the protection of threatened species and ecological communities that have been affected by bushfire, which are repeated here:

- ***Require consent authorities to consider the impacts of the 2019-20 bushfires before determining development applications, including updated environmental assessments where necessary.***

  Specifically, we recommend:

  - As an immediate step, consent authorities should seek additional information under clause 54 of the *Environmental Planning and Assessment Regulation 2000* in relation to the specific impacts of the development in conjunction with the impacts of the bushfires.

  - The Planning Minister exercise his powers under the EP&A Act to make a draft State Environmental Planning Policy (**SEPP**) for bushfire affected areas (similarly draft LEPs could be made for bushfire-impacted areas). The draft SEPP should be directed at addressing the impacts of the bushfires in conjunction with the impacts of proposed and approved development, and at the least:
    a) Impose a requirement that consent authorities must consider, before granting consent, updated environmental assessments for all proposed development that is likely to impact on threatened species and communities that have been heavily impacted by the Bushfire Emergency; and
    b) Provide the Planning Secretary and Local Councils with the power to modify or revoke existing consents for development that is likely to impact on threatened species and communities that have been heavily impacted by the Bushfire Emergency.[52]

[51] Letter from Environmental Defenders Office and Humane Society International Australia to The Hon. Gladys Berejiklian, Premier of NSW, dated 25 February 2020, available at https://www.edo.org.au/wp-content/uploads/2020/02/HSI-EDO-Letter-to-NSW-Premier-re-Bushfire-Emergency.pdf

[52] Section 4.57 of the EP&A Act provides the Planning Secretary and Local Councils with the express power to modify or revoke development consent having regard to the provisions of a draft SEPP or LEP.

- ***Regional Forest Agreements (RFAs) be revised to take into account the extensive forest losses that have resulted from the bushfires***

  RFAs in place in NSW permit the harvesting of forest products at no more than "sustainable yields". Sustainable yields are defined or calculated in accordance with the terms of the relevant RFA. However, there is now an urgent need to review the sustainable yield calculations under each RFA, so that they take into account the extensive forest losses that have resulted from the bushfires.

  We recommend that the NSW Government initiates a general review that, at a minimum, addresses the following criteria:

  - How the bushfires have impacted the Comprehensive, Adequate and Representative (**CAR**) Reserve System; and

  - Whether the CAR Reserve System fulfills its purpose as identified in the *National Forest Policy Framework* and the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* (the 'JANIS Report').

- ***Current forestry operations be suspended, where their continuation would affect remaining stands of habitat for threatened species***

  Given the significant impacts of the bushfires on threatened species habitat, it is in the public interest for forestry operations to be suspended while the damage from the bushfires is assessed, and a plan put in place to mitigate that damage. At a minimum all logging should be excluded from known and likely habitat of those animals and plants identified by the Commonwealth and/or NSW Governments as most significantly affected by the bushfires until the required surveys fully assess impacts and recovery needs. Ultimately, it may be in the public interest for certain forestry approvals to be revoked, in circumstances where continued logging operation would affect remaining stands of habitat for threatened species.

  The Deputy Premier and Environment Minister are jointly empowered to revoke, suspend, or amend an Integrated Forestry Operations Approval (**IFOA**) at any time.[53] Additionally, the Deputy Premier, as the Portfolio Minister of the NSW Forestry Corporation, has the power, with the approval of the Treasurer, to issue a direction to the board of the Forestry Corporation, if the Deputy Premier is satisfied that, because of exceptional circumstances, the direction is in the public interest.[54] The 2019-20 bushfires clearly constitute exceptional circumstances.

- ***Wildlife licences are suspended until the impacts of the bushfires on relevant wildlife has been fully assessed***

  Given the impacts of the bushfires on populations of native species, we recommend that the Environment Minister take steps to ensure that:

[53] *Forestry Act 2012*, s 69R.
[54] *State Owned Corporations Act 1989*, s 20P.

- no new licences under section 2.11 of the *Biodiversity Conservation Act 2016* (**BC Act**)to injure or take wildlife (for commercial purposes or otherwise) be granted; and
- where necessary, any existing licence relating to species that have been heavily impacted by the bushfires is suspended or revoked pursuant to section 2.15 of the BC Act;

until a comprehensive assessment of the impacts of the bushfires is undertaken and any necessary mitigation and recovery measures are put in place.

With the bushfires having killed an estimated 800 million animals in NSW and as the impacts of the climate crisis take hold, now is the moment to listen to the science and use our legal protections to aid in the recovery of species and reduce risks of future fires.

Recommendations

- **Recommendation 14:** Require consent authorities to consider the impacts of the 2019-20 bushfires before determining development applications, including updated environmental assessments where necessary.
- **Recommendation 15:** Revise Regional Forest Agreements (RFAs) to take into account the extensive forest losses that have resulted from the bushfires.
- **Recommendation 16:** Suspend current forestry operations, where their continuation would affect remaining stands of habitat for threatened species.
- **Recommendation 17:** Suspend wildlife licences until the impact of the bushfires on relevant wildlife has been fully assessed.

Attachment 1

The influence of fire on subsequent risk and the role of prescribed burning

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March 2020

I have prepared this advice in response to a request from the Environmental Defenders Office. The advice considers the influence of fire on subsequent fire risk and the role of prescribed burning in fire management. Two forms of landscape analysis have been used to measure the influence of fire on subsequent risk: fire *leverage*, and the *flammability ratio*.

Leverage involves the simple comparison of area burnt by bushfires each year with the area of recently burnt forest present in that year. To date, analyses in NSW have only identified weak and non-significant relationships between these two measures, and these have more often been negative than positive. That is, for more parts of the state, fire has been more likely when the area of recently burnt forest is larger.[1] This relationship applies in areas including the south-east corner, south-east Queensland and south-western slopes bioregions; all of which experienced major fires this past season.[2]

Flammability ratio is a stronger analysis, measuring the direct effect of every past fire on the spread of all parts of each subsequent fire, effectively providing a mass-series of case studies. To date, all forest communities examined using this technique have shown the same trend but with differing intensities: three periods of flammability have been evident. Initially, forests have been unlikely to burn for 2-6 years after a preceding fire ('young' period), most likely to burn for approximately the next two decades ('regrowth' period), but then *unlikely to burn* for an indefinite period after this ('mature' period).

This finding of a decline in the flammability of mature forests is of central importance to the question of prescribed burning. It is a trend consistent with studies of other disturbances such as logging,[3] has a clear causal mechanism in the changes that disturbance promotes in vegetation,[4] and has long been predicted from such changes.[5] The implication is simple, but opposite to popular belief: heightened flammability is a response to disturbance. Current fire management, however, focuses on a planned regime of disturbance, measuring success from the short-term reduction in risk following disturbance, without considering the long-term increased risk that ultimately results.

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[1] Price, O. F. *et al.* Global patterns in fire leverage: the response of annual area burnt to previous fire. *Int. J. Wildl. Fire* **24**, 297–306 (2015)., Price, O. F., Penman, T. D., Bradstock, R. A., Boer, M. M. & Clarke, H. G. Biogeographical variation in the potential effectiveness of prescribed fire in south-east Australia. *J. Biogeogr.* **42**, 2234–2245 (2015).

[2] Fires burning in these areas include the events that destroyed homes at Mallacoota, Cobargo, Wondalga and Rappville.

[3] Taylor, C., McCarthy, M. A. & Lindenmayer, D. B. Nonlinear effects of stand age on fire severity. *Conserv. Lett.* **7**, 355–370 (2014).

[4] Gosper, C. R., Prober, S. M. & Yates, C. J. Multi-century changes in vegetation structure and fuel availability in fire-sensitive eucalypt woodlands. *For. Ecol. Manage.* **310**, 102–109 (2013)., Dixon, K. M., Cary, G. J., Worboys, G. L., Seddon, J. & Gibbons, P. A comparison of fuel hazard in recently burned and long-unburned forests and woodlands. *Int. J. Wildl. Fire* **27**, 609–622 (2018).

[5] Zylstra, P. J. The historical influence of fire on the flammability of subalpine Snowgum forest and woodland. *Vic. Nat.* **130**, 232–239 (2013), Kitzberger, T. *et al.* Fire–vegetation feedbacks and alternative states: common mechanisms of temperate forest vulnerability to fire in southern South America and New Zealand. *New Zeal. J. Bot.* **54**, 247–272 (2016). Tepley, A. J. *et al.* Influences of fire-vegetation feedbacks and post-fire recovery rates on forest landscape vulnerability to altered fire regimes. *J. Ecol.* 1–16 (2018). doi:10.1111/1365-2745.12950, Tiribelli, F., Kitzberger, T. & Morales, J. M. Changes in vegetation structure and fuel characteristics along post-fire succession promote alternative stable states and positive fire-vegetation feedbacks. *J. Veg. Sci.* **29**, 147–156 (2018).

In the context of a changing climate, increased rates of disturbance will therefore result in a more flammable landscape, and a positive feedback where fire promotes more fire. Such so-called *landscape traps*[6] have the potential to accelerate fire frequency and impact until vulnerable ecosystems collapse.[7] Mitigation activities have the potential to either combat this cycle, or accelerate it even further by increasing the rate of disturbance.

Case studies of burning effectiveness have frequently failed to detect this pattern due to their design. These contrast fire behaviour in the young period with what they refer to as "long-unburnt", but this so-called long-unburnt vegetation is at times only a few years old itself, and almost never older than 20 years.[8] In reality, these studies have contrasted the flammability of young vegetation with that of regrowth rather than mature forest. The regrowth period is, however, a product of the fire itself. The 2-6 years of low flammability may be a benefit of burning, but the following decades of increased flammability are a cost imposed by it. When this is treated as if it is mature forest, the cost of burning is falsely treated as if it is a cost of *not* burning.

Current NSW Government modelling tools used for planning prescribed burning programs do not account for the decline in flammability of mature forests, and this has significant consequences. An example from the NSW koala populations illustrates the effect.

Analysis of threats to koalas by the DPIE Saving our Species[9] program identified that koala populations favour mature forests over regrowth, but also listed this preference for mature forest as a threat due to the perceived higher flammability of those forests and the vulnerability of koalas to fire. One population located at Numeralla in the state's south was identified to be predominantly at risk from fire, so the University of Melbourne was contracted to model strategies for fire risk mitigation. Their analysis utilised the software Phoenix RapidFire – a tool jointly owned by the University and three fire authorities including the NSW RFS.[10] Phoenix models fire on the assumption that mature forest is the most flammable period rather than the least, and, as the model cannot calculate the direct risk of fire to fauna, this study also assumed that prescribed burns would have no impact on koalas. Based on these two premises, the researchers concluded that the most effective use of prescribed burning for koala risk reduction was to burn koala habitat forest every 7 years.[11]

A dissenting report to the NSW Government on the same population was prepared by the University of Wollongong as part of a NSW Environmental Trust project "Modelling fire risk to fauna". In contrast to

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[6] Lindenmayer, D. B., Hobbs, R. J., Likens, G. E., Krebs, C. J. & Banks, S. C. Newly discovered landscape traps produce regime shifts in wet forests. *Proc. Natl. Acad. Sci. U. S. A.* **108**, 15887–15891 (2011).

[7] Kitzberger, T., Aráoz, E., Gowda, J. H., Mermoz, M. & Morales, J. M. Decreases in fire spread probability with forest age promotes alternative community states, reduced resilience to climate variability and large fire regime shifts. *Ecosystems* **15**, 97–112 (2012).

[8] Fernandes, P. A. M. & Botelho, H. S. A review of prescribed burning effectiveness in fire hazard reduction. *Int. J. Wildl. Fire* **12**, 117–128 (2003)., Fernandes, P. A. M. Empirical support for the use of prescribed burning as a fuel treatment. *Curr. For. Reports* **1**, 118–127 (2015)., McCaw, W. L. Managing forest fuels using prescribed fire - A perspective from southern Australia. *For. Ecol. Manage.* **294**, 217–224 (2013).

[9] Rennison, B. & Fisher, M. *Framework for the spatial prioritisation of koala conservation actions in NSW. Saving our Species Iconic Koala Project.* (2018).

[10] https://www.acnc.gov.au/charity/361f8be445a08946300aa253c55b6120

[11] Parkins, K., Cirulis, B. A. & Penman, T. D. *Fire risk management of populations of the koala Phascolarctos cinereus in the NSW southern tablelands: A simulation study.* (2019).

the first study, this used a mechanistic model (FRaME[12]) that could account for the effects of vegetation dynamics on flammability and measure the direct impact of fire on the koalas. In contrast to the Phoenix modelling, FRaME predicted that prescribed burns would not only increase the flammability of the koala habitat and the consequent likelihood of wildfire by encouraging the growth of a flammable understorey, they would directly impact the koalas themselves. Frequent prescribed burns would result in increases in the likelihood that koalas would receive 2nd degree burns by up to 810%, 3rd degree burns by up to 1200%, and create the likelihood of immediate mortality where it would not have existed if the forest was left in its long-unburnt state.

These examples illustrate a central issue in fire management. Although it has existential consequences for individuals, communities, species and ecosystems, management bodies do not hold the evidence used to assess the efficacy of tools such as prescribed burning to the same standards as are expected for other highly consequential industries, such as medicine. Leverage values for example are used to inform planning, despite having no statistical significance. Statistical significance has long been used in science as the test by which hypotheses are accepted or rejected, yet not only is its importance ignored in this case, the results are selectively accepted. For example, prescribed burning has not been stopped in those areas where the leverage study suggested it was increasing fire risk.

The underpinning theory for prescribed burning derives from a leaflet published in 1967,[13] claiming a direct correlation between the weight of leaf litter (termed the 'fuel load') and the behaviour of a fire. This claim was never subjected to the basic standards of peer-review applied to other areas of science, and, despite decades of research, no peer-reviewed evidence has yet been published in its support. In fact, subsequent tests published in peer-reviewed literature have consistently falsified the theory.[14] Research conducted using this model has a pre-determined outcome: more burning will be recommended. In my opinion, research that does not provide inputs to this model may be treated by agencies as irrelevant, if the model is their only available tool for management.

In my opinion, government agencies tasked with implementing such consequential measures have a responsibility to ensure that the evidence underpinning their actions meets the basic standards expected in other fields of science. At the same time, however, those agencies are tasked with implementing existing management objectives that may have arisen from non-scientific bases, which in my opinion can give rise to conflicts of interest. This has the further potential to bias future research. In my opinion, this is a core impediment to effective fire management in Australia, and our capacity to face the challenges of a changing climate may depend on our ability to overcome it.

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[12] The Fire Research and Modelling Environment. Zylstra, P. J. *et al.* Biophysical mechanistic modelling quantifies the effects of plant traits on fire severity: species, not surface fuel loads determine flame dimensions in eucalypt forests. *PLoS One* **11**, e0160715 (2016). Zylstra, P. J. Mechanistic fire modelling in R using FRaME: from plant traits to impacts on fauna, flora and soils. *Methods Ecol. Evol.* **Under Review**, (2020).

[13] Gould, J. S., McCaw, W. L. & Cheney, N. P. Quantifying fine fuel dynamics and structure in dry eucalypt forest (Eucalyptus marginata) in Western Australia for fire management. For. Ecol. Manage. 262, 531–546 (2011)., McArthur, A. G. Fire behaviour in Eucalypt forests. Forestry and Timber Bureau Leaflet 107. in *9th Commonwealth Forestry Conference* 26 (1967).

[14] Burrows, N. D. Fire behaviour in Jarrah forest fuels. *CALMScience* **3**, 31–84 (1999)., Cheney, N. P., Gould, J. S., McCaw, W. L. & Anderson, W. R. Predicting fire behaviour in dry eucalypt forest in southern Australia. *For. Ecol. Manage.* **280**, 120–131 (2012)., Zylstra, P. J. *et al.* Biophysical mechanistic modelling quantifies the effects of plant traits on fire severity: species, not surface fuel loads determine flame dimensions in eucalypt forests. *PLoS One* **11**, e0160715 (2016).

Key recommendations for the use of prescribed burning in mitigating bushfire risk

- **Recommendation 1. The value of long-undisturbed forest in mitigating landscape fire risk is recognized in fire management planning**

Three stages of recognition are required. Firstly, ecosystems that have been shown to decline in flammability with maturity should be recognized. Secondly, the evidence that this appears to be a broadly applicable principle due to disturbance-related changes in vegetation should provide the baseline assumption for areas where the dynamics have not yet been measured. Thirdly, research should be directed toward addressing the gaps in this knowledge, including measurement of timing and feedback strength, potential exceptions, and potential complicating factors.

Recognition will require that this knowledge is incorporated into fire management planning, so that mature forests are not intentionally disturbed, strategies and resources are engaged to capitalize on their lower flammability, and other strategies are developed to progress regrowth forests into a mature state where possible.

- **Recommendation 2. Prescribed burning and other methods of reducing risk via disturbance are applied close to assets where they may provide material benefit**

Due to the nature of flammability dynamics, these interventions will only be of value if applied frequently and intensively, maintaining forests in their 'young' state. This has the potential to lead to environmental degradation, so it should only be conducted at a location and scale where this loss is deemed acceptable or unavoidable, or can be mitigated.

- **Recommendation 3. Fire management is regulated and assessed for efficacy by an external body that is not also responsible for implementing Government objectives**

A regulating body must be free to question Government policy and not be tasked with meeting KPIs that are open to question.

- **Recommendation 4. Scientific research is independent from Government policy**

Scientific research must be independent from Government policy, and in particular:

- Research funding should not be administered by an agency tasked with enacting Government policies which could be questioned by that research.
- Agencies responsible for enacting policy should divest from companies such as Phoenix fire predictions Ltd that legally bind them to management actions which may be questioned by research